

Pesticide and PCB Residues in the Neuse River Waterdog, *Necturus lewisi*

RUSSELL J. HALL

*U. S. Fish and Wildlife Service,
Patuxent Wildlife Research Center, Laurel, Maryland 20708*

RAY E. ASHTON, JR.¹

*North Carolina State Museum of Natural History,
P. O. Box 27647, Raleigh, North Carolina 27611*

AND

RICHARD M. PROUTY

*U. S. Fish and Wildlife Service,
Patuxent Wildlife Research Center*

ABSTRACT.— Residues of six organochlorine contaminants were found in *Necturus lewisi* from six sites in the Tar and Neuse river systems. Concentrations of pesticides were low and apparently related to geographic patterns of use. Levels of PCBs were higher and did not seem to vary geographically.

INTRODUCTION

The Neuse River Waterdog, *Necturus lewisi*, is a large, aquatic salamander endemic to the Tar and Neuse river systems, North Carolina. This paper reports the results of analysis of tissues to determine pesticide and polychlorinated biphenyl (PCB) residue levels. This is only the second published report of residues in salamanders, and the first report that deals with an aquatic species. Some of the streams inhabited by the salamander drain lands subject to frequent pesticide applications (Reeves et al. 1977), and one of our sampling localities was the site of a 1979 PCB "spill".

Ten animals of various sizes were collected from two Coastal Plain and three Piedmont Plateau localities in the Neuse River drainage. Specimens were frozen soon after capture and shipped in dry ice from Raleigh to the Patuxent Wildlife Research Center. Carcasses were prepared for analysis by removal of gastrointestinal tracts. Either a 10-g portion or the whole homogenized carcass was mixed thoroughly with anhydrous sodium sulfate, then extracted with hexane in a Soxhlet apparatus for 7 hours. Extracts were cleaned up on a partially deactivated Florisil column, and pesticides and PCB's were separated into four fractions on a Silicar column (Kaiser et al. 1980).

¹ Present address: International Expeditions, Inc., 1776 Independence Court, Birmingham, AL 35216.

Residues were quantified using a gas-liquid chromatograph equipped with an electron-capture detector and a 1.5% OV-17/1.95% QF-1 column. Residues in 10% of the samples were confirmed by mass spectrometry. Recoveries of pesticides and PCBs from fortified tissues averaged 93%, but residues reported were not corrected for recovery. The lower limit of reportable residues was 0.01 ppm for pesticides and 0.05 ppm for PCBs. All residue levels are expressed on a whole-body wet weight basis.

Pesticide residues in tissues (Table 1) were of low to moderate levels and indicate contamination from a variety of sources. The presence of DDT metabolites (DDD and DDE) and the absence of unaltered DDT suggest that no recent sources of that discontinued pesticide exist in the area. Residues of its metabolites probably are the result of applications made in past years. Both *cis*-chlordane and *trans*-nonachlor are constituents of chlordane, a pesticide now used almost exclusively for termite control.

Table 1. Residues of pesticides and PCBs in *Necturus lewisi*.

Compound ¹	Geometric mean of residues (ppm) ²	Frequency of occurrence
DDE	0.06	1.0
DDD	0.04	0.7
Dieldrin	0.02	0.4
<i>cis</i> -chlordane	0.02	0.7
<i>trans</i> -nonachlor	0.04	0.2
PCB 1254	0.39	1.0

¹ Heptachlor epoxide, oxychlordane, *cis*-nonachlor, endrin, toxaphene, HCB, and mirex were not detected at the 0.01 ppm level of sensitivity.

² Calculated on a whole-body wet weight basis; only those with measurable residues were used in calculation of means.

Higher levels of DDE were found in Coastal Plain animals than in those from Piedmont Plateau localities, and they occurred more frequently in larger animals (> 30 g) than in smaller ones (< 30 g). Specimens from the Coastal Plain averaged 0.11 ppm DDE, while those from the Piedmont averaged 0.02 ppm. Similarly, larger individuals averaged 0.15 ppm while smaller ones averaged 0.04 ppm. Two-way analysis of variance shows that both trends are significant ($p < 0.05$). Dieldrin residues were common in Coastal Plain specimens (frequency = 0.67), but absent from Piedmont specimens. They also were more common in larger specimens than in smaller ones (frequencies 0.6 and 0.2, respectively). Components of chlordane showed a pattern similar to that of dieldrin, with greatest contamination in specimens from lowland sites.

Values for PCB residues, usually associated with industrial or municipal wastes, were higher than those for pesticides. They tended to be consistently high (range 0.2-1.2 ppm) in both Coastal Plain and Piedmont sites and among animals of all sizes; no effect of the reported spill is evident.

A 1971 pesticide monitoring study (Reeves et al. 1977) was conducted in Wayne County (Piedmont) and Wilson County (Coastal Plain) localities that lie between our collecting sites. Their samples were taken before the use of DDT was phased out, but neither DDT nor dieldrin was applied in 1971 to the areas sampled. Therefore, levels of DDT, its metabolites, and dieldrin should represent nearly maximum background levels for tissues. Frogs sampled at that time had lower residues than *N. lewisi* sampled in the same general area, eight years later. Fish sampled in the 1971 study had higher residues, particularly of the short-lived contaminants. In the only previous study of residues in salamanders, Dimond et al. (1968) found in Maine that DDT and its metabolites in *Plethodon cinereus* reached an average of 0.8 ppm soon after the area was sprayed, and took eight or nine years to drop to background levels (< 0.01 ppm).

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